Рамановский микроскоп RM5
Технические характеристики

По вопросам продаж и поддержки обращайтесь:

Алматы (7273)495-231
Ангарск (3955)60-70-56
Архангельск (8182)63-90-72
Астрахань (8512)99-46-04
Барнаул (3852)73-04-60
Белгород (4722)40-23-64
Благовещенск (4162)22-76-07
Брянск (4832)59-03-52
Владивосток (423)249-28-31
Владикавказ (8672)28-90-48
Владимир (4922)49-43-18
Волгоград (844)278-03-48
Вологда (8172)26-41-59
Воронеж (473)204-51-73
Екатеринбург (343)384-55-89
Иваново (4932)77-34-06
Ижевск (3412)26-03-58
Иркутск (395)279-98-46
Казань (843)206-01-48
Калининград (4012)72-03-81
Калуга (4842)92-23-67
Кемерово (3842)65-04-62
Киров (8332)68-02-04
Коломна (4966)23-41-49
Кострома (4942)77-07-48
Краснодар (861)203-40-90
Красноярск (391)204-63-61
Курск (4712)77-13-04
Курган (3522)50-90-47
Липецк (4742)52-20-81
Магнитогорск (3519)55-03-13
Москва (495)268-04-70
Мурманск (8152)59-64-93
Набережные Челны (8552)20-53-41
Нижний Новгород (831)429-08-12
Новокузнецк (3843)20-46-81
Ноябрьск (3496)41-32-12
Новосибирск (383)227-86-73
Омск (3812)21-46-40
Орел (4862)44-53-42
Оренбург (3532)37-68-04
Пенза (8412)22-31-16
Петрозаводск (8142)55-98-37
Псков (8112)59-10-37
Пермь (342)205-81-47
Ростов-на-Дону (863)308-18-15
Рязань (4912)46-61-64
Самара (846)206-03-16
Саранск (8342)22-96-24
Санкт-Петербург (812)309-46-40
Саратов (845)249-38-78
Севастополь (8692)22-31-93
Симферополь (3652)67-13-56
Смоленск (4812)29-41-54
Сочи (862)225-72-31
Ставрополь (8652)20-65-13
Сургут (3462)77-98-35
Сыктывкар (8212)25-95-17
Тамбов (4752)50-40-97
Тверь (4822)63-31-35
Тольятти (8482)63-91-07
Томск (3822)98-41-53
Тула (4872)33-79-87
Тюмень (3452)66-21-18
Ульяновск (8422)24-23-59
Улан-Удэ (3012)59-97-51
Уфа (347)229-48-12
Хабаровск (4212)92-98-04
Чебоксары (8352)28-53-07
Челябинск (351)202-03-61
Череповец (8202)49-02-64
Чита (3022)38-34-83
Якутск (4112)23-90-97
Ярославль (4852)69-52-93

Россия +7(495)268-04-70
Киргизия +996(312)-96-26-47
Казахстан +7(7172)727-132

eti@nt-rt.ru || https://edinst.nt-rt.ru/

RM5 RAMAN MICROSCOPE

The RM5 is a compact and fully automated Raman microscope for analytical and research purposes. The truly confocal design of the RM5 is unique to the market and offers uncompromised spectral resolution, spatial resolution, and sensitivity.

The RM5 builds on the expertise of robust and proven building blocks, combined with modern optical design considerations; and a focus on function, precision and speed. The result is a modern Raman microscope that stands alone in both specifications and ease of use.

KEY FEATURES

- **Truly Confocal –** with variable slit and multiple position adjustable pinhole for higher image definition, better fluorescence rejection and application optimisation
- **Integrated Narrowband Raman Lasers –** up to 3 computer-controlled lasers for ease of use, enhanced stability and reduced footprint
- **5-Position Grating Turret –** for unrivalled spectral resolution of <0.3 cm^{-1} and optimisation over the full spectral range <50 cm^{-1} - 15,000 cm^{-1}
- **Integrated Detectors –** up to 2, including high efficiency CCD, EMCCD and InGaAs arrays for low noise, increased speed, high sensitivity and wide spectral range
- **Internal Standards and Auto-Calibration –** to ensure the highest quality data at all times
- **4-Position Raman Filter Turret –** fully automated notch and edge filters to match the Raman range to excitation laser wavelength
- **Ramacle® Software –** one powerful software package for complete system control, data acquisition, analysis and ease of upgrade
- **High Performance Microscope –** compatible with all the latest accessories

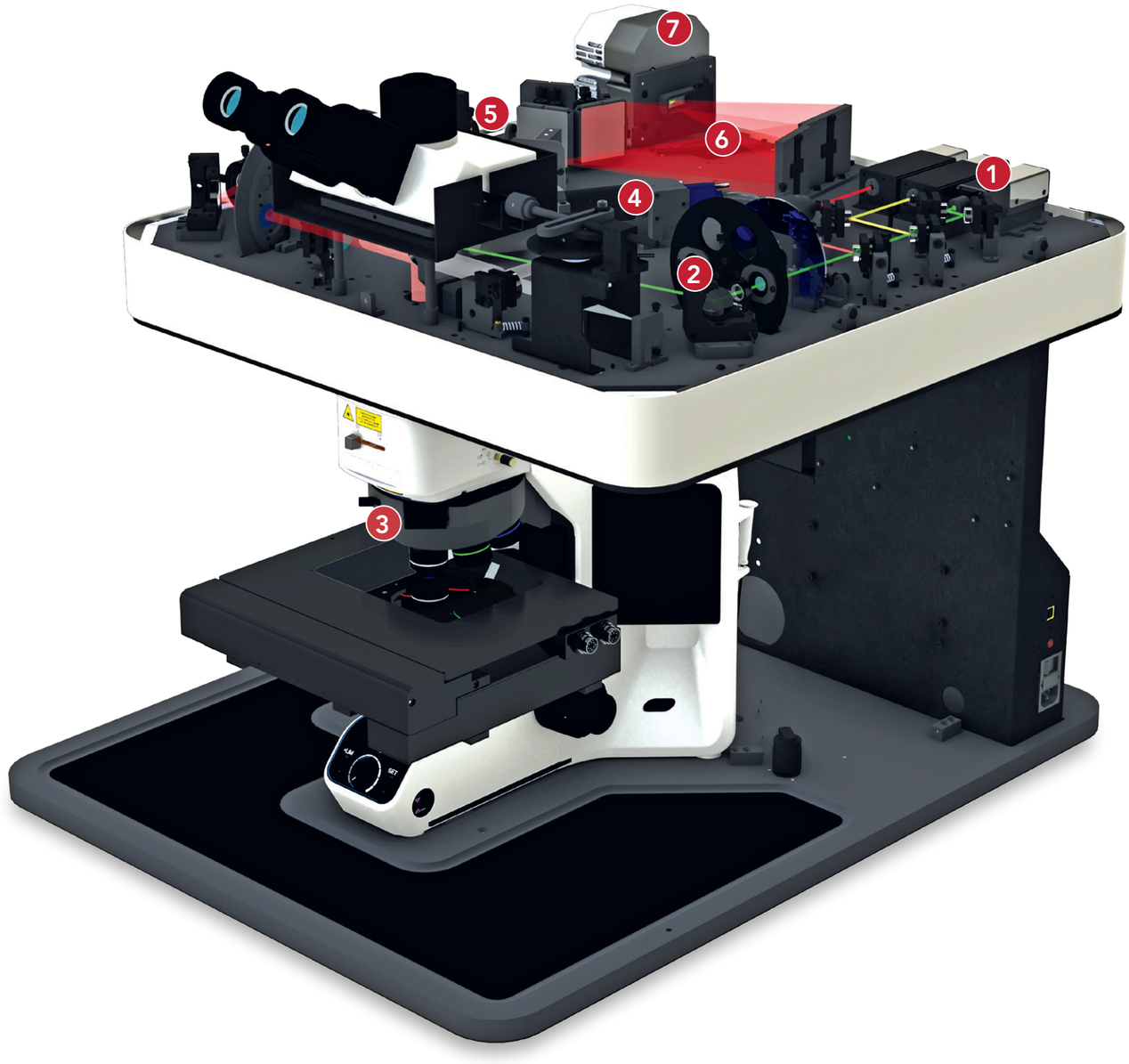
> **A MODERN RAMAN MICROSCOPE THAT STANDS ALONE IN BOTH SPECIFICATIONS AND EASE OF USE.**

PRECISION
RAMAN

COSMETICS | SEMICONDUCTORS | ART & MUSEUM | FORENSICS | GEOLOGY

RM5
DESIGN FEATURES

Laser excitation, from one of three possible lasers (1), is directed to the microscope and sample stage via a series of motorised mirrors with laser power at the sample controlled through an adjustable attenuator. The beam is focussed onto the sample that sits on an XYZ-movable stage (3) through a microscope objective, and can be viewed live on screen thanks to an integrated CMOS camera (4). The scattered light produced is then collected by the same objective before being passed through a filter to remove unwanted laser light. The Raman scattered light passes through an adjustable confocal pinhole (5) before entering the spectrograph. One of five possible diffraction gratings splits the light into its constituent wavelengths (6) which are then focussed onto the detector(s) (7) and displayed to the user as a spectrum.



1 Multiple Lasers

Up to 3 integrated and computer-controlled lasers with choice of wavelengths, combined with a computer-controlled continuous laser beam attenuator to allow control over laser power at the sample position.

2 Automated Calibration

For recalibration and validation, the RM5 comes with integrated Raman reference materials. Internal standards are included for spectrograph calibration and for laser wavelength calibration and adjustment.

All calibration and validation routines are part of the instrument's operating software, Ramacle®, and allow for complete ease-of-use and user-friendliness.

3 High Performance Microscope

The latest generation research-grade upright microscope (Olympus BX53 series), allows the RM5 to benefit from all modern sample visualisation and contrast enhancement techniques available including brightfield, darkfield, polarised light, Nomarski differential interference contrast (DIC) and fluorescence. A manual or computer-controlled XYZ stage provides movement to locate and map areas of interest on the sample.

4 Live Sample Viewing

An embedded high resolution CMOS camera for field-of-view visualisation, sample set-up and laser beam alignment is included as standard. A second camera can be attached to the trinocular head of the microscope for higher resolution and image stitching of Raman mapping.

5 Automated Optical Routing

This compartment contains a 4-position turret of dichroic laser rejection filters, computer-controlled beam splitter and an adjustable confocal pinhole. Auto-alignment of the instrument is achieved by two embedded piezo-controlled mirrors. An optional polariser and analyser accessory is available for advanced analysis of polarised Raman scattering.

6 High Resolution Spectrograph

A high resolution spectrograph of asymmetric Czerny-Turner design is integrated. This includes a continuously adjustable precision slit and a grating turret with up to 5 pre-aligned gratings for wide spectral coverage. The spectrograph undergoes comprehensive calibration and validation procedures at the factory.

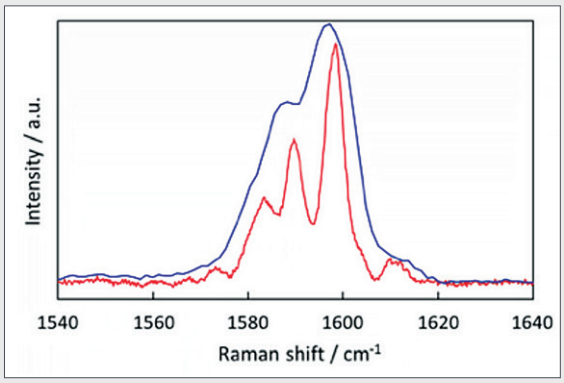
7 Multiple Detector Ports

Thermo-electrically cooled spectroscopic CCD cameras are used for low noise and fast image detection. A second CCD camera port is available for a camera with complementary spectral coverage, increased speed, higher spectral sampling or sensitivity, pushing the flexibility of the RM5.

SPECTRAL RESOLUTION

High spectral resolution is essential for a state-of-the-art Raman microscope. With high spectral resolution all Raman features of a sample will be revealed including lines that are in close proximity.

The integrated grating turret of the RM5 can be loaded with up to 5 gratings of different spectral dispersions so that an industry leading spectral resolution down to <0.3 cm^{-1} and spectral coverage up to 15,000 cm^{-1} are only a mouse-click away.



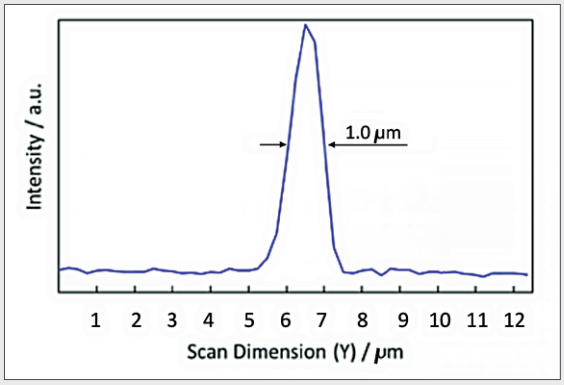
Triptycene triplet, excited by 785 nm laser, 600 g/mm grating (blue) and 1800 g/mm grating (red), arbitrary scaled

SPATIAL RESOLUTION

The RM5 comes with exceptional spatial resolution allowing features to be discriminated down to <1 µm.

A wide choice of objectives and a truly confocal system with adjustable pinhole for spatial filtering provides excellent flexibility and allows the spatial resolution to be optimised depending on the sample requirements.

Highly spatially resolved Raman maps can be acquired and superimposed over the white light sample image recorded by an integrated CMOS camera.



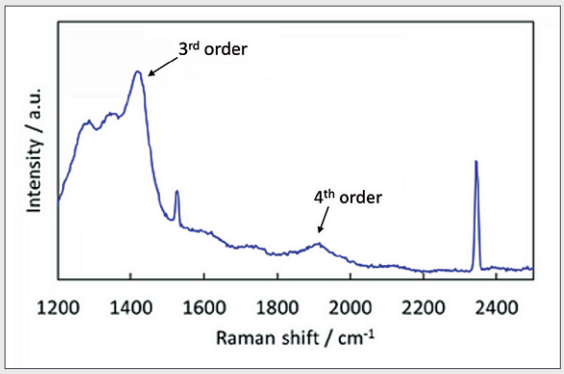
1 µm Polystyrene bead scanned over a distance 12 µm, excited with 532 nm laser

SENSITIVITY

High sensitivity is important in order to detect the smallest of Raman signals and allows faster measurements of high resolution Raman maps to be performed.

The high Raman sensitivity of the RM5 is a consequence of appropriate laser power, high quality optics and an efficient CCD camera. Sensitivity is further enhanced by using a truly confocal arrangement for the suppression of background signals caused by sample fluorescence or other background artefacts.

Detection of the 4th order Silicon band at 1940cm^{-1} provides evidence of the ultimate Raman sensitivity.

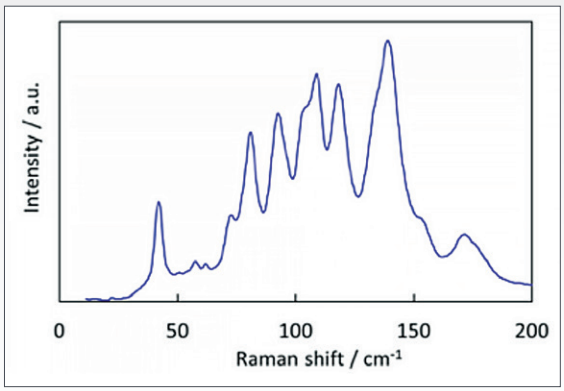


Silicon, excited with 532 nm laser

LOW WAVENUMBER PERFORMANCE

Measurements of low energy Raman shifts with standard Raman instrumentation are often difficult or impossible to perform as the laser's Rayleigh scatter may mask Raman features in this region.

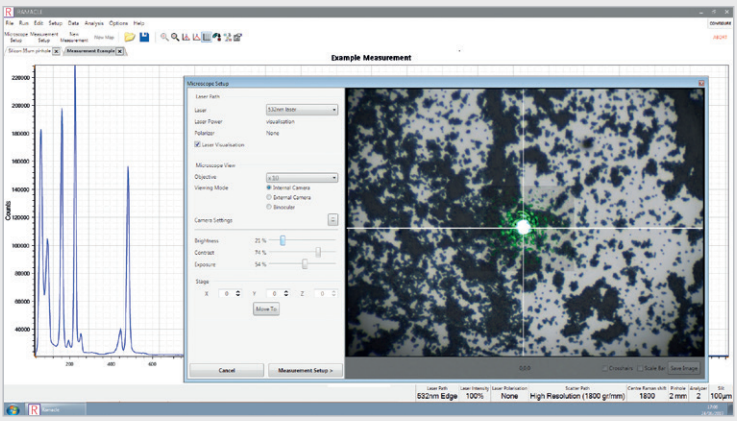
Using high quality optics and the best filters available the RM5 demonstrates exceptional low wavenumber performance down to <50 cm^{-1}, depending on the laser wavelength.



L-Histidine, excited with 785 nm laser

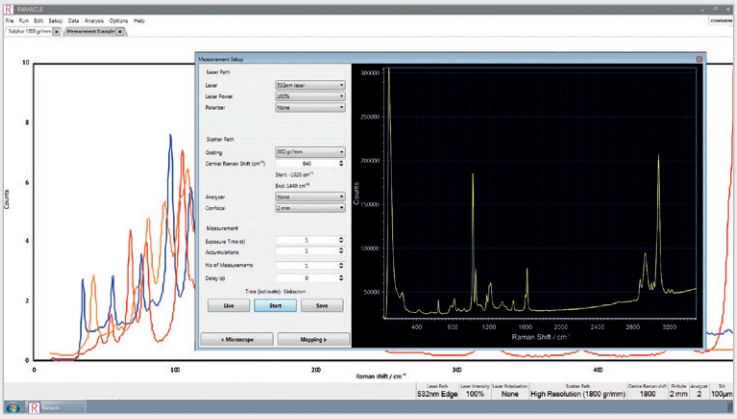
RAMACLE® SOFTWARE

Ramacle is an exceptional software package written for complete instrument control and data handling on the RM5 system. Ramacle controls all RM5 functions with a straightforward design concept. It focuses on all modern Raman spectroscopy applications, while at the same time, providing a user-friendly interface with 'ready to publish' outputs.



The software provides control, visualisation, data acquisition, analysis and presentation of the RM5 whether it is used for generating Raman spectra or with advanced upgrades such as Raman mapping.

Ramacle enables sample visualisation, live signal monitoring and parameter optimisation before every measurement. The instrument status and signal are displayed and constantly updated during measurements.



Data generated by Ramacle have a proprietary file format. This contains all measurement and instrumental properties, allowing the user to retrieve important information whenever needed and ensures data traceability. Simple input and output functions provide the required compatibility with third party data analysis or presentation packages.

KnowItAll™ Raman Identification Pro spectral library is available for material identification and advanced analysis. Data acquisition methods such as single measurements, multiple and accumulated scans, kinetic scans and generation of maps (accessory dependent) are implemented by intuitive and in user-friendly wizards.

RAMACLE KEY FEATURES

- Selection of laser and scatter optical pathways
- Selection of excitation wavelength, gratings and exposure time
- Sample and laser focus visualisation
- Programmed attenuator and shutter
- Single, accumulated and kinetic spectral acquisitions
- Spectral correction
- Selection and scans of internal calibration standards and automated calibration correction
- Data operations such as arithmetic, scaling, normalisation and baseline subtraction
- Cosmic ray removal, cropping, smoothing
- Automated laser alignment
- ASCII / CSV data import / export function
- Paste options for presentations and publications

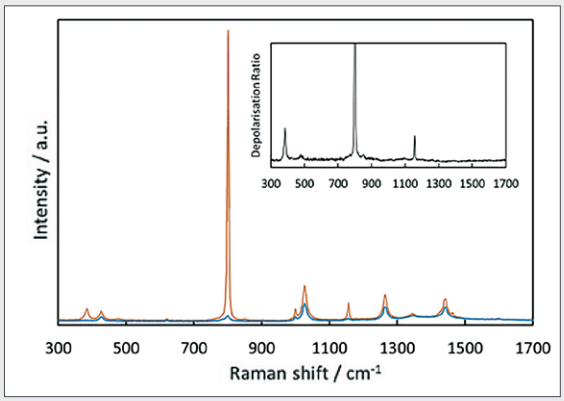
FEATURES INCLUDED WITH UPGRADES

- Mapping features - map setup, collection and data analysis
- Fully motorised stage - XYZ control through joystick and software
- Polariser and analyser selection and control
- Detectors selection
- Laser rejection filter selection
- External camera selection and visualisation

POLARISED RAMAN SPECTROSCOPY

Optional accessories in the RM5 allow the user to control the polarisation of the excitation light and analyse different Raman scattering polarisations. Examining spectral information obtained by polarised Raman spectroscopy can provide insights into the symmetry of vibrational modes, as well as the orientation of samples such as single crystals, polycrystalline samples, and anisotropic materials.

For example, cyclohexane contains several peaks which arise from exclusively symmetrical vibrations, as indicated in the depolarisation ratio function.

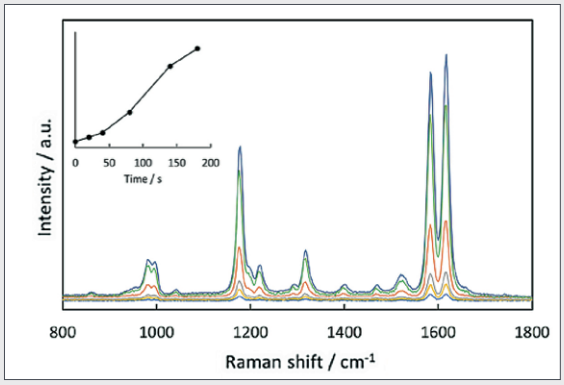


Cyclohexane, excited with 785 nm laser. Parallel polarised intensity (orange), perpendicular polarised intensity (blue). Inset: Depolarisation ratio.

KINETIC MEASUREMENTS USING SERS

Surface-Enhanced Raman Scattering (SERS) is a method for enhancing Raman signals. Samples of interest are brought in proximity or attached to a roughened metal surface with nanoscale features. The excitation laser interacts with plasmons on the surface of the metal, resulting in significantly increased Raman signals.

Metal colloids with the use of a suitable aggregating agent are common materials for SERS. The signal progression with time can be monitored to understand when the maximum signal is reached.

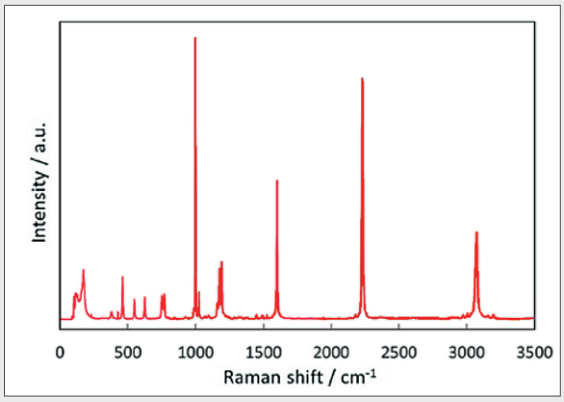


Raman spectrum of 1,2(4-pyridyl)ethylene 40 nm Au, recorded over time, showing the significant enhancement of the signal intensity of this SERS sample.

HIGH RESOLUTION EXTENDED SCAN

The 5-position grating turret of the RM5 can be equipped with gratings for a variety of measurements. Low groove density gratings provide measurements over a broad spectral range with lower resolution; whereas high groove density gratings measure over a narrower range but with higher resolution.

To measure high resolution spectra over a broad range an extended scan can be used. Ramacle seamlessly stitches the CCD data together to create a single spectrum which gives the advantage of both high resolution and broad spectral coverage.



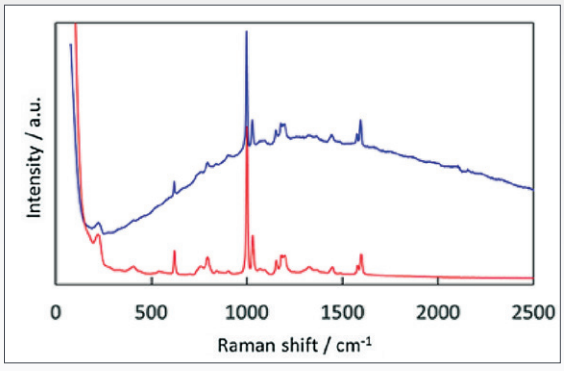
Benzonitrile, excited with 532 nm laser. Multiple spectra joined together. The resulting spectrum contains 6700 data points with 3500 cm^{-1} spectral coverage and a resolution of 0.54 cm^{-1} per pixel.

REDUCTION OF FLUORESCENCE BACKGROUND

Some samples, in particular those that contain biological materials, can show a significant amount of background signal, often caused by fluorescence.

As fluorescence requires the presence of absorption (or resonant excitation), the amount of this unwanted background can be controlled by selection of an appropriate excitation wavelength.

The RM5 can have up to 3 different lasers fitted, allowing the user to optimise the excitation wavelength for the best Raman result with minimum background interference.



Paracetamol / Caffeine / Phenylephrine Hydrochloride tablet, excited with 638 nm laser (blue) and 785 nm laser (red).

MAPPING

Mapping the Raman spectra within a sample area provides previously unavailable information about the chemical and physical differences across a sample. This can confirm the identity and presence of specific components, and reveals their location and distribution within the sample.

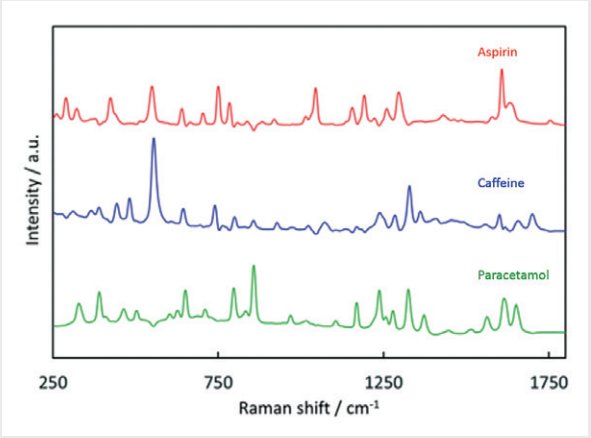
This powerful technique is employed in many industries:

- In Material Sciences it can investigate how structure, stress and strain vary across a sample
- In Biology and Life Sciences it can be used to image tissues, whole cells or their components without the need for dyes and stains; or to locate Raman and SERS tags
- In Pharmaceuticals it can be applied to identify ingredients and analyse their distribution when developing and producing drugs. The data shown on this page are from a commercial composite pain killer tablet

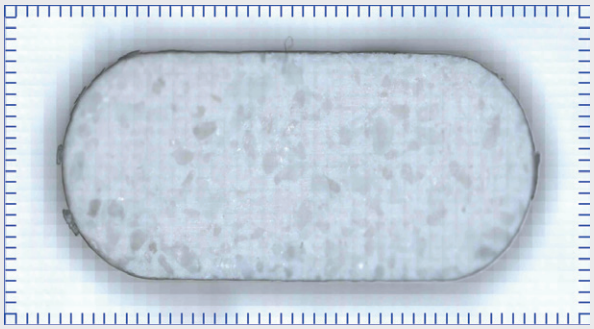
The RM5 generates Raman maps using a motorised stage for sample scanning, which permits finely controlled movement in the X, Y and Z directions. Line scans, plane maps, and volume maps can be created.

The adjustable, truly confocal arrangement of the RM5 facilitates exceptional spatial resolution in all three dimensions.

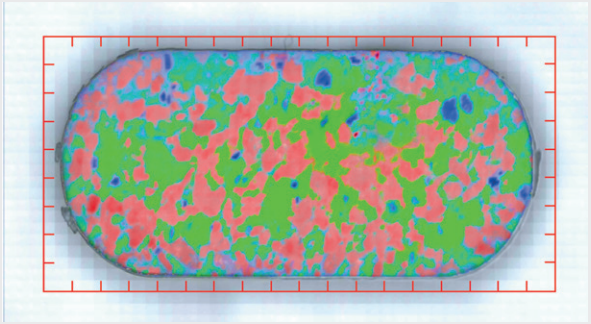
Thanks to the superb sensitivity of the RM5, detailed maps based on high quality and highly resolved spectra can quickly be produced.



Raman spectra of the constituents of a commercial pharmaceutical tablet, excited with 785 nm laser.



White light image of the tablet under investigation.
Using a 10x objective, the image has been composed of 1,650 (55 x 30) individual white light images automatically acquired and stitched together into one large image by Ramacle. The blue grid scale shows the frame size of the individual images.



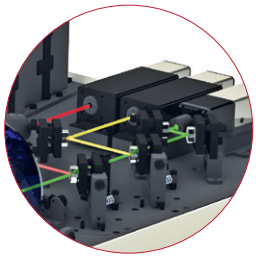
Raman map superimposed on the white light image.
Using the same 10x objective, 785 nm laser excitation, and a 50 µm pinhole, spectra were collected at 100 µm steps along the X and Y axes. This results in over 18,000 individual Raman acquisitions.

The matrix of spectra was then analysed and superimposed onto the white light image using Ramacle software. The colours in the resulting map represent Aspirin (red), Caffeine (blue) and Paracetamol (green) demonstrated by their Raman spectra above. The red grid scale shows the area that was scanned for Raman with 1 mm graduation.

UPGRADE OPTIONS

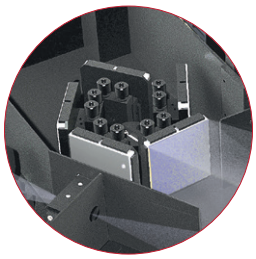
LASERS

The RM5 is built with flexibility in mind. A choice of excitation lasers and associated laser rejection filters (both edge and notch) are available depending on application requirements.



GRATINGS

Gratings are chosen for optimum resolution for each laser excitation, with up to a maximum of five gratings per system.

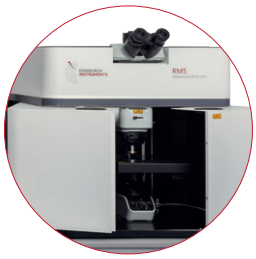


DETECTORS

A choice of CCD, EMCCD and InGaAs detectors are also available dependent on requirements, with a maximum of two detectors being integrated per system.

ACCESSORIES AND LASER SAFETY

Other accessories such as a polarisation kit and a Class I laser safety enclosure are also available to further expand the capabilities, flexibility and safety of your RM5 system.



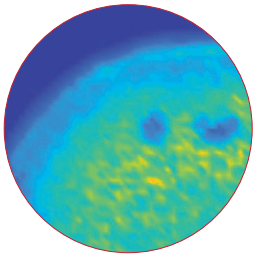
MICROSCOPE

The RM5 uses one of the most modern microscopes on the market for first class Raman microscopy. You can use the microscope beyond pure Raman microscopy; the RM5 has been designed to maintain the full capability of the microscope allowing all the necessary tools to be added for exceptional visualisation and contrast of your samples.

Brightfield, darkfield, polarised light, differential interference contrast (DIC) and fluorescence are all available. Alongside a choice of high quality microscope objectives, a high performance camera can be added to the microscope to ensure pictures of your samples (and associated Raman maps) are captured with excellent quality and resolution.

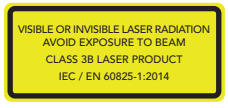
SAMPLE STAGES

A choice of microscope stages, including manual and an XYZ motorised stage which allows ease of navigation around your samples and stage area. Automated Raman maps can be obtained and generated through Ramacle. Heating/cooling of stages is also available.



SPECIFICATIONS – RM5

LASERS		Up to 3 integrated narrow-band lasers: 532 nm, 638 nm, 785 nm typically used
		Additional lasers are available
		Laser selection is fully computer-controlled
		Associated laser rejection filters included, fully computer-controlled
SPECTROGRAPH	Wavelength Range	400 nm - 2,200 nm
	Gratings	5-position grating turrets
	Slits	Continuously adjustable, fully computer-controlled
SPECTRAL RESOLUTION		From <0.3 cm^{-1} (depending on grating, laser and CCD selection)
SPECTRAL RANGE		<50 cm^{-1} - 15,000 cm^{-1}
CONFOCAL IMAGING		Adjustable confocal pinhole, fully computer-controlled
DETECTORS	CCD Detector	High sensitivity ultra low noise spectroscopy CCDs
		1650 x 200 pixels, TE-cooled -60°C (standard)
		2000 x 256 pixels, TE-cooled -60°C (enhanced sensitivity / spectral range)
	Optional Second Detector	EMCCD detector, 1600 x 200 pixels, TE-cooled -100°C (fast response time)
		InGaAs array, 1024 pixel, TE-cooled -90°C, up to 2,200 nm
SOFTWARE	Ramacle®	Comprehensive all-in-one, intuitive software package
	Optional	Chemometric, spectral library packages
FLUORESCENCE	Spectral	With low resolution grating and integrated CCD
LASER SAFETY	Without Laser Enclosure	Class 3B (depending on external laser source)
	With Laser Enclosure	Class 1
DIMENSIONS	W x D x H	From 600 mm x 800 mm x 600 mm
	Weight	From 63 kg



По вопросам продаж и поддержки обращайтесь:

Алматы (7273)495-231
Ангарск (3955)60-70-56
Архангельск (8182)63-90-72
Астрахань (8512)99-46-04
Барнаул (3852)73-04-60
Белгород (4722)40-23-64
Благовещенск (4162)22-76-07
Брянск (4832)59-03-52
Владивосток (423)249-28-31
Владикавказ (8672)28-90-48
Владимир (4922)49-43-18
Волгоград (844)278-03-48
Вологда (8172)26-41-59
Воронеж (473)204-51-73
Екатеринбург (343)384-55-89
Иваново (4932)77-34-06
Ижевск (3412)26-03-58
Иркутск (395)279-98-46
Казань (843)206-01-48
Калининград (4012)72-03-81
Калуга (4842)92-23-67
Кемерово (3842)65-04-62
Киров (8332)68-02-04
Коломна (4966)23-41-49
Кострома (4942)77-07-48
Краснодар (861)203-40-90
Красноярск (391)204-63-61
Курск (4712)77-13-04
Курган (3522)50-90-47
Липецк (4742)52-20-81
Магнитогорск (3519)55-03-13
Москва (495)268-04-70
Мурманск (8152)59-64-93
Набережные Челны (8552)20-53-41
Нижний Новгород (831)429-08-12
Новокузнецк (3843)20-46-81
Ноябрьск (3496)41-32-12
Новосибирск (383)227-86-73
Омск (3812)21-46-40
Орел (4862)44-53-42
Оренбург (3532)37-68-04
Пенза (8412)22-31-16
Петрозаводск (8142)55-98-37
Псков (8112)59-10-37
Пермь (342)205-81-47
Ростов-на-Дону (863)308-18-15
Рязань (4912)46-61-64
Самара (846)206-03-16
Саранск (8342)22-96-24
Санкт-Петербург (812)309-46-40
Саратов (845)249-38-78
Севастополь (8692)22-31-93
Симферополь (3652)67-13-56
Смоленск (4812)29-41-54
Сочи (862)225-72-31
Ставрополь (8652)20-65-13
Сургут (3462)77-98-35
Сыктывкар (8212)25-95-17
Тамбов (4752)50-40-97
Тверь (4822)63-31-35
Тольятти (8482)63-91-07
Томск (3822)98-41-53
Тула (4872)33-79-87
Тюмень (3452)66-21-18
Ульяновск (8422)24-23-59
Улан-Удэ (3012)59-97-51
Уфа (347)229-48-12
Хабаровск (4212)92-98-04
Чебоксары (8352)28-53-07
Челябинск (351)202-03-61
Череповец (8202)49-02-64
Чита (3022)38-34-83
Якутск (4112)23-90-97
Ярославль (4852)69-52-93

Россия +7(495)268-04-70
Киргизия +996(312)-96-26-47
Казахстан +7(7172)727-132

eti@nt-rt.ru || https://edinst.nt-rt.ru/